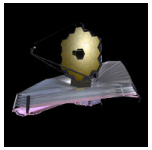

1865 - Witnessing the Circumgalactic Medium in Formation: The Warm Dust and Molecular Gas in a Record-Breaking Galactic Wind

Cycle: 1, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1	MIRI imaging F770W+F1130W+F1800W+F2100W+F2550W	MIRI Imaging	(1) MAKANI
	2	NIRCam Imaging F480M + F187N	NIRCam Imaging	(1) MAKANI

ABSTRACT

The amount of dust outside of galaxies, inferred from reddening measurements of background quasars and galaxies by foreground galaxy halos, is comparable to that within galaxies, but the origin of this dust is uncertain. Numerical simulations suggest that galactic winds, driven by stellar or SMBH processes, are the primary source of the enriched circumgalactic medium (CGM), but the direct detection of dust in a galactic wind on the relevant CGM scale remains elusive. The recently discovered 100-kpc (>20 r_stellar) wind in Makani, a massive galaxy at z = 0.459, is an excellent target to test this idea. The cooler neutral-atomic and molecular gas phases in this wind coexist with the warm ionized gas out to distances of 20 kpc but apparently not beyond. This provides tantalizing evidence that we are witnessing, for the first time on CGM scale, the dissolution of the outflowing cool clouds into the warm ionized phase as predicted by theory. Our proposed MIRI/NIRCam multi-band imaging of the warm dust and molecular gas in Makani will fill the temperature gap between the warm ionized gas and cool molecular/neutral-atomic material and capture this critical phase transition. This program takes advantage of a remarkable coincidence between several key spectral features of Makani and the bandpasses of the MIRI/NIRCam filters. These data will allow us to (1) determine whether dust grains experience evolution as they travel to large distances from the host galaxy, (2) assess the impact of the dynamic CGM on the processing of the warm H_2 molecules in the wind, and (3) provide a holistic view of the dust-H_2 cycle in forming galaxy-CGM ecosystems which will inform future modeling.

OBSERVING DESCRIPTION

We will image Makani using MIRI and NIRCam with the following settings:

-MIRI imaging
  acquisition: point and shoot
  FULL array
  4-point extended source dither pattern
  Readout mode: FAST
  Filters F770W, F1130W, F1800W, F2100W, and F2550W
   (sequentially, in order of increasing wavelength to avoid persistence)
  F770W: 60 groups and 3 exposures per dither position
  --> total exposure time on source: 33 min
  F1130W: 34 groups and 5 exposures per dither position
  --> total exposure time on source: 31 min

F1800W: 28 groups and 6 exposures per dither position
--> total exposure time on source: 31 min
F2100W: 28 groups and 9 exposures per dither position
--> total exposure time on source: 47 min
F2550W: 20 groups and 16 exposures per dither position
--> total exposure time on source: 60 min
No off-source background images

-NIRCam imaging
acquisition: point and shoot
Module B only
SUB400P subarray
No primary dither, STANDARD subpixel dither, 4 subpixel positions
Readout mode: MEDIUM8
Filters F480M (long) and F187N (short) simultaneously
10 groups and 5 integrations per dither position
--> total exposure time on source: 54 min
No off-source background images

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	MAKANI	RA: 21 18 24.0587 (319.6002446d) Dec: +00 17 29.45 (.29151d) Equinox: J2000	Proper Motion RA: -5.078732401225699E-4 sec of time/yr Proper Motion Dec: 0.002221 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Active galaxies, Starburst galaxies]

Observation

Proposal 1865, Observation 1: MIRI imaging F770W+F1130W+F1800W+F2100W+F2550W

Tue Feb 07 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: MIRI Imaging

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	MAKANI	RA: 21 18 24.0587 (319.6002446d) Dec: +00 17 29.45 (.29151d) Equinox: J2000	Proper Motion RA: -5.078732401225699E-4 sec of time/yr Proper Motion Dec: 0.002221 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Active galaxies, Starburst galaxies]

Template

Subarray
FULL

Dithers

#	Dither Type	Starting Point	Number of Points	Points	Starting Set	Number of Sets	Optimized For	Direction	Pattern Size
1	CYCLING	1	4		5	1			LARGE

Spectral Elements

#	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F770W	FASTR1	54	5	1	Dither 1	4	20	3041.444	53420
2	F1130W	FASTR1	38	7	1	Dither 1	4	28	3019.244	53420
3	F1800W	FASTR1	29	9	1	Dither 1	4	36	2985.943	53420
4	F2100W	FASTR1	28	11	1	Dither 1	4	44	3529.851	53420
5	F2550W	FASTR1	20	19	1	Dither 1	4	76	4417.864	53420

Special Requirements

No Parallel Attachments

Observation

Proposal 1865, Observation 2: NIRCam Imaging F480M + F187N

Tue Feb 07 00:00:30 GMT 2023

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	MAKANI	RA: 21 18 24.0587 (319.6002446d) Dec: +00 17 29.45 (.29151d) Equinox: J2000	Proper Motion RA: -5.078732401225699E-4 sec of time/yr Proper Motion Dec: 0.002221 arcsec/yr Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Active galaxies, Starburst galaxies]

Template

Module	Subarray
B	SUB400P

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F187N	F480M	MEDIUM8	10	5	20	4	3279.765	53420